2014 Korea International Mathematics Competition

21~26 July, 2014, Daejeon City, Korea

Elementary Mathematics International Contest

TEAM CONTEST

Time：60 minutes

Instructions:

- Do not turn to the first page until you are told to do so.
- Remember to write down your team name in the space indicated on every page.
- There are 10 problems in the Team Contest, arranged in increasing order of difficulty. Each question is printed on a separate sheet of paper. Each problem is worth 40 points. For Problems 1, 3, 5, 7 and 9, only numerical answers are required. Partial credits will not be given. For Problems 2, 4, 6, 8 and 10, full solutions are required. Partial credits may be given.
- The four team members are allowed 10 minutes to discuss and distribute the first 8 problems among themselves. Each student must attempt at least one problem. Each will then have 35 minutes to write the solutions of their allotted problem independently with no further discussion or exchange of problems. The four team members are allowed 15 minutes to solve the last 2 problems together.
- No calculator or calculating device or electronic devices are allowed.
- Answer must be in pencil or in blue or black ball point pen.
- All papers shall be collected at the end of this test.

English Version

For Juries Use Only

No.	1	2	3	4	5	6	7	8	9	10	Total	Sign by Jury
Score												
Score												

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1. Exactly one pair of brackets is to be inserted into the expression

$$2\times2-2\times2-2\times2-2\times2-2\times2.$$

The left bracket must come before a 2 and the right bracket after a 2. Determine the largest possible value of the resulting expression.

Answer: _____

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2. Divide the 18 numbers 1, 2, ..., 18 into nine pairs such that the sum of the two numbers in each pair is the square of an integer.

Answer: (,) (,) (,)
(,) (,) (,)
(,) (,) (,)

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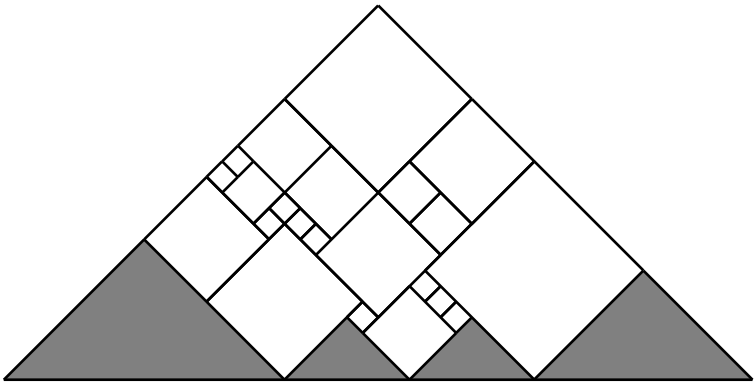
3. The diagram below shows a right isosceles triangle partitioned into four shaded right isosceles triangles and a number of squares. The side lengths of all the squares are positive integers. The smallest ten squares are of side length 1 cm. Determine the total area, in cm^2, of the four shaded triangles.



Answer: _____ cm^2

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4. Each of the five families living in apartments 2, 3, 4, 6 and 12 in a building will adopt one of five cats, whose ages are 1, 2, 3, 4 and 6. The adopting family's apartment number must be divisible by the age of the cat. Find all possible adoption schemes.

Answer:

	1-year-old	2-year-old	3-year-old	4-year-old	6-year-old
(1)					
(2)					
(3)					
(4)					
(5)					
(6)					
(7)					
(8)					
(9)					
(10)					
(11)					
(12)					
(13)					
…					

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5. The positive integers 1, 2, ..., 2014 strung together form a very long multi-digit number 12345678910111213...201220132014. A seven-digit multiple of 11 is obtained by erasing all the digits before it and all the digits after it. Determine the smallest possible value of this seven-digit number, which may not start with the digit 0.

Answer: _____

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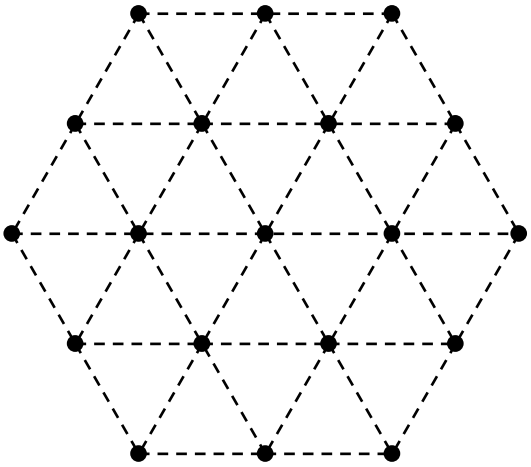
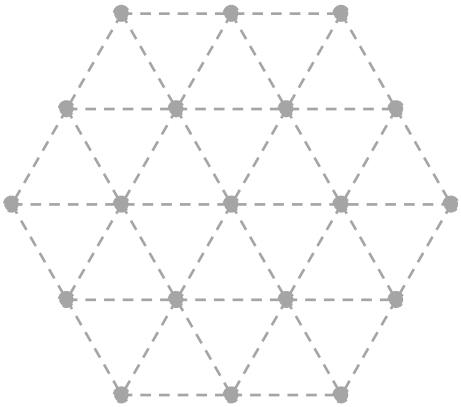
6. The diagram below shows a hexagonal configuration of 19 dots in an equilateral triangular grid.
   (a) Determine the number of equilateral triangles of different sizes with all three vertices among the 19 dots. Draw an equilateral triangle of each size on the diagram.
   (b) Determine the number of equilateral triangles of each size.





Answer: (a) _____ different sizes

(b) _____

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7. Each of teams *A*, *B*, *C*, *D* and *E* plays against every other team exactly once. A win is worth 3 points, a draw 1 point and a loss 0 points. At the end of the tournament, no two teams have the same number of points. *A* has the highest number of points despite losing to *B*. Neither *B* nor *C* loses any game, but *C* has fewer points than *D*. How many points does *E* have?

Answer: _____ points

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8. *P* is a point inside a square *ABCD* of side length 8 cm. What is the largest possible value of the area, in cm^2, of the smallest one among the six triangles *PAB*, *PBC*, *PCD*, *PDA*, *PAC* and *PBD*?

Answer: _____ cm^2

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9. A sequence of 2014 two-digit numbers is such that each is a multiple of 19 or 23, and the tens digit of any number starting from the second is equal to the units digit of the preceding number. If the last number in the sequence is 23, determine the first number in the sequence.

Answer: _____

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10. There are ten real coins all of the same weight. There is a fake coin which is heavier than a real coin, and another fake coin which is lighter than a real coin. You cannot tell the coins apart. Explain how, in four weighings using a balance, you may determine whether the total weight of the two fake coins is greater than, equal to or less than the total weight of two real coins?

Answer: _____